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Physical activity and personality change in people with chronic respiratory diseases: Evidence from two longitudinal samples

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ABSTRACT

Lower physical activity in people with chronic respiratory diseases is related to detrimental health outcomes. However, no study has investigated the moderating role of physical activity on personality change in this population. This study aimed to fill this gap by examining the association between physical activity and personality change in people with chronic respiratory diseases. Participants (N = 2253; age range: 24–97) were drawn from two US longitudinal samples with multiple self-report measures of personality and physical activity collected over a follow-up period ranging from 12 to 18 years. Controlling for demographic factors, a random-effects meta-analysis showed that overall higher physical activity during follow-up was related to smaller declines in extraversion and conscientiousness. There was no association with changes in neuroticism, openness to experience and agreeableness. These findings highlight that physical activity in individuals with chronic respiratory diseases predicts individual differences in personality trait change, and may contribute to more favorable trajectories, which could promote better health outcomes.

1. Introduction

Physical activity is a key issue for people suffering from chronic respiratory diseases (CRD), especially as these individuals are less active than healthy age-matched controls (Cordova-Rivera et al., 2018; Vorrink et al., 2011). In this population, lower physical activity is associated with deleterious outcomes, including deterioration of health-related quality of life (Dogra et al., 2018), exacerbations (Waschki et al., 2012), hospitalizations (Benzo et al., 2010), and mortality (Waschki et al., 2011). In addition, lower physical activity has been associated with worse psychological functioning such as greater fatigue and lower self-efficacy (Andersson et al., 2015; Selzler et al., 2020). However, no research has yet examined whether physical activity level in people with CRD are related to changes in their characteristic ways of behaving, thinking, and feeling that are their personality traits.

According to the Five-Factor Model (FFM: Digman, 1990; McCrae & John, 1992), personality traits are organized along five broad dimensions: neuroticism (i.e., tendency to experience negative emotions and stress), extraversion (i.e., tendency to be outgoing and to experience positive emotions), openness to experience (i.e., tendency to be curious and enjoy new experiences), agreeableness (i.e., tendency to be empathic and trusting), and conscientiousness (i.e., tendency to be organized and self-disciplined). People with CRD who have higher levels of neuroticism and lower levels of extraversion and conscientiousness tend to experience poorer health-related quality of life (Axelsson et al., 2013), reduced pulmonary function, and greater dyspnea (Stephan et al., 2023). Although personality traits are defined as relatively stable, it is now well-established that they change across the lifespan (Bleidorn et al., 2022; Graham et al., 2020; Roberts et al., 2017). Importantly, personality stability and change over time can be conceptualized using a two-by-two table that crosses the level of analysis (population vs. individual) with the type of change (absolute vs. relative). This yields four main approaches: mean-level change, individual differences in change, rank-order change, and ipsative change (for details, see Roberts et al., 2008). From a mean-level perspective, a normative decline across all five personality traits is observed from middle adulthood, with the magnitude of these cumulative mean-level changes through adulthood exceeding one standard deviation for several traits (Bleidorn et al.,

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2022). Regarding CRD, a longitudinal study has shown that the onset of such conditions is associated with distinct patterns of mean-level changes. These patterns are characterized by an increase in neuroticism and accelerated declines in extraversion, openness, agreeableness, and conscientiousness, compared to normative age-related trajectories (Jokela et al., 2014). Such changes may be deleterious for some individuals because they may have negative consequences on health (Wright & Jackson, 2023b). For example, decreases in conscientiousness have been linked to deterioration in health status. Therefore, examining the sources of individual differences in personality trait change among people with CRD is crucial for advancing theoretical understanding of the factors that shape personality change in the context of chronic conditions.

In order to explain individual variability in personality change, theoretical models, such as the sociogenomic model (Roberts & Jackson, 2008) and the TESSERA framework (Wrzus & Roberts, 2017) emphasize that long-term personality changes result from repeated short-term state processes. Within this framework, physical activity has emerged as a relevant contextual factor that may influence personality trajectories by affecting daily experiences and state expressions over time. Indeed, physical activity is often a social endeavor, providing opportunities for interpersonal interaction that may influence extraversion and agreeableness states. Moreover, maintaining regular physical activity requires conscientious behaviors, which could affect levels of conscientiousness, even more so for people with CRD due to the burden of symptoms (Miravitlles & Ribera, 2017). Physically active individuals also tend to feel energized and adopt open behaviors (e.g., exploring a variety of activities), which may impact extraversion and openness to experience. Supporting these assumptions, evidence from the general population demonstrates that higher levels of physical activity are associated with smaller declines in extraversion, openness, agreeableness, and conscientiousness, while findings regarding neuroticism remain inconsistent (Allen et al., 2015; Allen et al., 2017; Stephan et al., 2014; Stephan et al., 2018).

In addition, these theoretical models of personality change postulate that biological factors can both trigger and reinforce these short-term states, thus influencing the trajectory of personality change (Jackson & Wright, 2024). Prior findings support these assumptions by linking personality change to biological factors such as inflammation and cognitive decline (Stephan et al., 2016, 2021), mechanisms that are particularly relevant for people with CRD, who are more prone to both (Gan et al., 2004; Van Beers et al., 2018). Physical activity, by modulating these biological mechanisms, might shape personality trajectories in this population. Indeed, higher physical activity levels in CRD are related to lower systemic inflammation (Moy et al., 2014) and less cognitive decline (Van Beers et al., 2018), which are both related to reduced declines in extraversion, openness, agreeableness, and conscientiousness (Stephan et al., 2016, 2021).

As previous work has shown that CRD are associated with specific patterns of mean-level personality changes compared to normative age-related trajectories (Jokela et al., 2014), we aimed to examine the sources of individual differences in these patterns. Our goal was to advance the theoretical understanding of personality change in this clinical population and to identify moderating factors that may help prevent changes that could be detrimental. Based upon two longitudinal samples of people with CRD, the present study investigated whether physical activity was associated with variability in personality change. Consistent with previous work (Allen et al., 2015; Allen et al., 2017; Stephan et al., 2014; Stephan et al., 2018), it was hypothesized that higher physical activity in individuals with CRD would be associated with smaller declines in extraversion, openness, agreeableness, and conscientiousness. No association between physical activity and neuroticism change was expected. Several sociodemographic factors known to influence personality traits trajectories were included as covariates, such as age, sex, education, and race (Graham et al., 2020; Sutin et al., 2022; Wright & Jackson, 2023a).

2. Method

2.1. Participants

Participants were drawn from the Health and Retirement Study (HRS) and the Midlife in the United States (MIDUS). The HRS was approved by the University of Michigan IRB. The MIDUS was approved by the Education and Social/Behavioral Sciences and the Health Sciences Institutional Review Board at the University of Wisconsin-Madison. The present study did not require IRB approval because it used publicly available de-identified data. Written informed consent was obtained from participants in the two cohorts. Participants were included if they had a CRD and provided complete data on physical activity, personality and sociodemographic data (i.e., age, sex, education and race) at baseline.

The HRS is a longitudinal study of Americans older than 50 years. HRS started to measure personality in 2006 wave for the half of the sample and in 2008 wave for the other half. To find out whether participants were suffering from a CRD, the interviewer asked the following question: “Has a doctor ever told you that you have chronic lung disease such as chronic bronchitis or emphysema?”. For other chronic respiratory conditions (e.g., asthma), the interviewer asked if the respondent had “any medical diseases or conditions that are important to your health now, that we have not talked about?” and reported the name of the disease. Participants who said “Yes” to the first question or provided the name of a CRD to the second question were included in this study. The final sample was composed of 1419 participants (62 % women, M_{age} = 69.41, SD = 9.69). Follow-up data on physical activity and personality were collected in 2010, 2014 and 2018 for the 2006 sample and in 2012, 2016, 2020 for the 2008 sample. Data from the 2006 and 2008 samples were aggregated. More information about the HRS can be found at https://hrs.isr.umich.edu.

The MIDUS is a longitudinal study of 7108 Americans adults. The first wave of the MIDUS collected survey data in 1995–1996. To define participants with CRD, the interviewer asked the following questions: “In the past 12 months, have you experienced or been treated for any of the following: asthma, bronchitis, or emphysema?”, “In the past 12 months, have you experienced or been treated for any of the following: other lung problems?”, and “What type of cancer have you had?”. Participants who answered “Yes” to the first two questions and “Lung cancer” to the third question were included in this study. Complete data on personality, physical activity, and sociodemographic factors were obtained from a total of 834 participants with CRD at baseline (61 % women, M_{age} = 47.57, SD = 13.25). Follow-up data on physical activity and personality were obtained from the second wave (2004–2005) and the third wave (2013–2014). More information about the MIDUS can be found at https://midus.wisc.edu.

2.2. Measures

2.2.1. Personality

In the two samples, personality traits were assessed using the Midlife Development Inventory (MIDI) (Lachman & Weaver, 1997). Participants were asked how much 26 adjectives that assessed neuroticism (e.g., mood), extraversion (e.g., outgoing), openness (e.g., curious), agreeableness (e.g., confident), and conscientiousness (e.g., organized) described them on a scale ranging from 1 (*not at all*) to 4 (*a lot*). In the two samples, we removed one item (i.e., careless) in accordance with the work of Zimprich et al. (2012). For each trait, the mean of the corresponding items was calculated. Across all waves, Cronbach alphas ranged from 0.70 to 0.77 for neuroticism, 0.72–0.75 for extraversion, 0.75–0.81 for openness, 0.77–0.85 for agreeableness and, 0.63–0.75 for conscientiousness in the HRS, and from 0.74 to 0.77, 0.74–0.77, 0.76–0.78, 0.75–0.79, and 0.56–0.69, respectively, in the MIDUS.

2.2.2. Physical activity

Physical activity was assessed at each wave in both samples. In the HRS sample, participants responded to two items asking how often they participated in vigorous and moderate physical activity on the following scale from 1 to 4: 1 (*more than once a week*); 2 (*once a week*); 3 (*one to three times a month*); 4 (*hardly ever or never*). In the MIDUS sample, participants reported their frequency of participation in vigorous and moderate physical activity during summer and winter months using the following scale from 1 to 6: 1 (*several times a week or more*); 2 (*about once a week*); 3 (*several times a month*); 4 (*about once a month*); 5 (*less than once a month*); 6 (*never*). Consistent with previous research (e.g., Wei et al., 2024), people were classified as physically active if they reported engaging in either moderate or vigorous physical activity several times per week, or if they reported engaging in both types of activity once a week. All other participants were classified as physically inactive. This approach aligns with current physical activity guidelines for people with chronic conditions (Piercy et al., 2018).

2.2.3. Covariates

Our analyses controlled for baseline age (centered on the sample mean and divided by 10 to scale coefficient per decade), sex (1 = women, 0 = men), race (1 = non-white, 0 = white), and education. Education was reported in years in the HRS and on a scale ranging from 1 (*no school / some grade school*) to 12 (*Ph.D. degree*) in the MIDUS. Additional analyses included behavioral and clinical covariates such as smoking (1 = current smokers, 0 = non-smokers and former smokers) and disease burden were conducted, given their association with both personality change and CRD (Jokela et al., 2014; Lundbäck et al., 2003; Negewo et al., 2015; Stephan et al., 2019). Disease burden was the sum of the following health conditions: stroke, diabetes, cancer, arthritis, heart disease and high blood pressure.

2.3. Data analysis

To test the extent to which physical activity explains variability in personality trait change among people with CRD during the follow-up period, longitudinal multilevel models were conducted for each trait (Singer & Willett, 2003). The data structure included repeated assessments (Level 1: Time) nested within participants (Level 2: Person). Time was coded in years, with 0 representing the baseline and 1 a decade. To distinguish between-person and within-person effects, time-varying dummy-coded physical activity (1 = physically active, 0 = physically inactive) was split into person-specific mean (i.e., between-person effect) and deviations from each person's mean (i.e., within-person effect) (Yaremych et al., 2023). Regarding the aim of the current study, we focused on the between-person effect. Personality traits were standardized to facilitate comparisons. Numeric covariates (i.e., education and disease burden) were also standardized.

For the analyses, null model was tested to calculate the intraclass correlation (ICC) to define the proportion of variance in personality traits explained by the interindividual variance. Secondly, a series of models for each personality trait was run. Model 1 included Time (β_{1i} $time_{ti}$) and within-person physical activity (β_{2i} PA_{ti}) as Level 1 predictors and between-person physical activity (PA_i), age, sex, education, and race as Level 2 predictors. To test the extent to which physical activity is related to individual differences in personality trait changes, the interaction between Time and between-person physical activity was added. Model 2 extended Model 1 by adding baseline smoking and disease burden as Level 2 predictors. Models (without time-invariant covariates) are expressed as follows:

$$\text{Level 1}: trait_{ti} = \beta_{0i} + \beta_{1i} time_{ti} + \beta_{2i} PA_{ti} + \varepsilon_{ti.}$$

$$\text{Level 2}: \beta_{0i} = \gamma_{00} + \gamma_{01} \times PA_i + r_{0i}$$

$$\beta_{1i} = \gamma_{10} + \gamma_{11} \times PA_i$$

Lastly, a random-effects meta-analysis of Models 1 and 2 was used for each personality trait. Heterogeneity was quantified using Q and τ^2 statistics. All analyses were performed using R Studio software (v. 2022.07.1) with the packages *lme4* for multilevel analyses (Bates et al., 2015), and *metafor* for meta-analysis (Viechtbauer, 2010). Analysis scripts are available on OSF (https://osf.io/zj9ht/).

3. Results

Descriptive statistics are detailed in Table 1. The ICC of the null model (without any predictor) in the two samples for the five personality traits ranged from 0.56 to 0.69. This indicated that between-individual variance accounts for 56 % to 69 % of the total variance in personality change while between 31 % to 44 % of the overall variance is attributable to within-individual variance, justifying the use of multilevel models. Results of Model 1 and Model 2 for each sample are reported in Table 2.

Controlling for age, sex, education, and race, the meta-analysis showed that overall physical activity during follow-up (i.e., between-person effect) predicts individual differences in changes in extraversion and conscientiousness (Table 2, Fig. 1). As shown on Fig. 2, overall higher levels of physical activity were associated with smaller declines in these traits. These findings remained significant when disease burden and smoking were included in the models. In contrast to the hypothesis, the meta-analysis revealed that overall physical activity during follow-up was unrelated to changes in openness and agreeableness, although there was a less pronounced decline of openness and agreeableness in the HRS sample (Table 2). Finally, between-person physical activity was not associated with neuroticism change in the meta-analysis, despite it was related to a steeper decline in neuroticism in the MIDUS sample (Table 2).

4. Discussion

The present study aimed to investigate the association between physical activity and personality change in people with CRD. Consistent with our hypothesis, results showed that higher physical activity during follow-up was associated with reduced declines in extraversion and conscientiousness. There was no relationship between physical activity and neuroticism change. Contrary to our hypothesis, physical activity during follow-up was not related to openness and agreeableness changes. These results remained similar when disease burden and smoking were added in the analyses. The present study suggests that physical activity in people with CRD could predict individual differences in personality trait change. Overall, this pattern of personality change related to physical activity is broadly consistent with past research conducted among large samples of middle-aged and older adults (Allen

Table 1
Baseline descriptive statistics of the samples.

Variables	HRS (N = 1419)		MIDUS (N = 834)	
	M | %	*SD*	*M* | %	*SD*
Age (years)	69.45	9.68	47.54	13.28
Sex (% women)	62 %	–	61 %	–
Race (% white)	87 %	–	91 %	–
Education	12.13	2.79	6.63	2.50
Disease burden[a]	2.40	1.29	0.93	1.08
Smoking (% current smokers)[a]	26 %	–	27 %	–
Physical activity (% active)	46 %	–	52 %	–
Neuroticism	2.20	0.66	2.35	0.68
Extraversion	3.12	0.56	3.18	0.56
Openness	2.89	0.54	3.01	0.54
Agreeableness	3.52	0.49	3.53	0.46
Conscientiousness	3.29	0.56	3.46	0.49

Note. Sample size differs in function of the inclusion of clinical covariates in models (i.e., disease burden; smoking).
[a] HRS: N = 1394; MIDUS: N = 813.

Table 2
Longitudinal multilevel models predicting personality change from physical activity.

		Fixed effects - Estimates (SE)				
		Neuroticism	Extraversion	Openness	Agreeableness	Conscientiousness
HRS[1]						
Intercept	Model 1	0.045 (0.049)	−0.322*** (0.049)	−0.161*** (0.047)	−0.347*** (0.048)	−0.200*** (0.049)
	Model 2	0.018 (0.052)	−0.282*** (0.052)	−0.137** (0.051)	−0.320*** (0.052)	−0.180*** (0.052)
Time	Model 1	−0.140** (0.051)	−0.331*** (0.050)	−0.305*** (0.050)	−0.274*** (0.053)	−0.332*** (0.054)
	Model 2	−0.129* (0.051)	−0.337*** (0.050)	−0.299*** (0.051)	−0.270*** (0.054)	−0.343*** (0.055)
Physical activity	Model 1	−0.234*** (0.065)	0.485*** (0.065)	0.315*** (0.063)	0.146* (0.064)	0.410*** (0.065)
	Model 2	−0.196** (0.066)	0.462*** (0.066)	0.318*** (0.064)	0.134* (0.065)	0.389*** (0.066)
Time * Physical activity	Model 1	−0.083 (0.084)	0.308*** (0.082)	0.187* (0.083)	0.274** (0.087)	0.240** (0.089)
	Model 2	−0.098 (0.085)	0.316*** (0.083)	0.173* (0.083)	0.275** (0.088)	0.238** (0.090)
MIDUS[2]						
Intercept	Model 1	0.285*** (0.064)	−0.247*** (0.065)	−0.099 (0.064)	−0.356*** (0.063)	−0.239*** (0.065)
	Model 2	0.204** (0.068)	−0.257*** (0.069)	−0.130 (0.069)	−0.383*** (0.068)	−0.224** (0.069)
Time	Model 1	−0.317*** (0.037)	−0.178*** (0.035)	−0.082* (0.035)	−0.068 (0.039)	−0.232*** (0.038)
	Model 2	−0.307*** (0.037)	−0.173*** (0.035)	−0.077* (0.035)	−0.066 (0.039)	−0.243*** (0.039)
Physical activity	Model 1	−0.452*** (0.083)	0.499*** (0.083)	0.423*** (0.083)	0.220** (0.082)	0.392*** (0.084)
	Model 2	−0.422*** (0.084)	0.493*** (0.085)	0.425*** (0.085)	0.222** (0.084)	0.361*** (0.085)
Time * Physical activity	Model 1	0.270*** (0.064)	0.116 (0.061)	−0.046 (0.060)	−0.033 (0.066)	0.130* (0.066)
	Model 2	0.258*** (0.065)	0.108 (0.062)	−0.043 (0.060)	−0.028 (0.067)	0.155* (0.067)
Random Effect (slope)	Model 1	0.098 (0.177)	0.204* (0.096)	0.063 (0.116)	0.115 (0.153)	0.169** (0.053)
	Model 2	0.084 (0.178)	0.205* (0.104)	0.057 (0.107)	0.118 (0.152)	0.184*** (0.054)
Heterogeneity Q	Model 1	11.29***	3.54	5.25*	7.82**	0.98
	Model 2	11.14***	4.06*	4.38*	7.51**	0.54
Heterogeneity τ^2	Model 1	0.057	0.013	0.022	0.041	0.000
	Model 2	0.058	0.016	0.018	0.040	0.000

Note. *** $p < .001$, ** $p < .01$, * $p < .05$. [1] HRS Model 1: $N = 1419$; Model 2: $N = 1394$. [2] MIDUS Model 1: $N = 834$; Model 2: $N = 813$.
Model 1: Adjusted by age, sex, education, and race.
Model 2: Model 1 with disease burden and smoking.

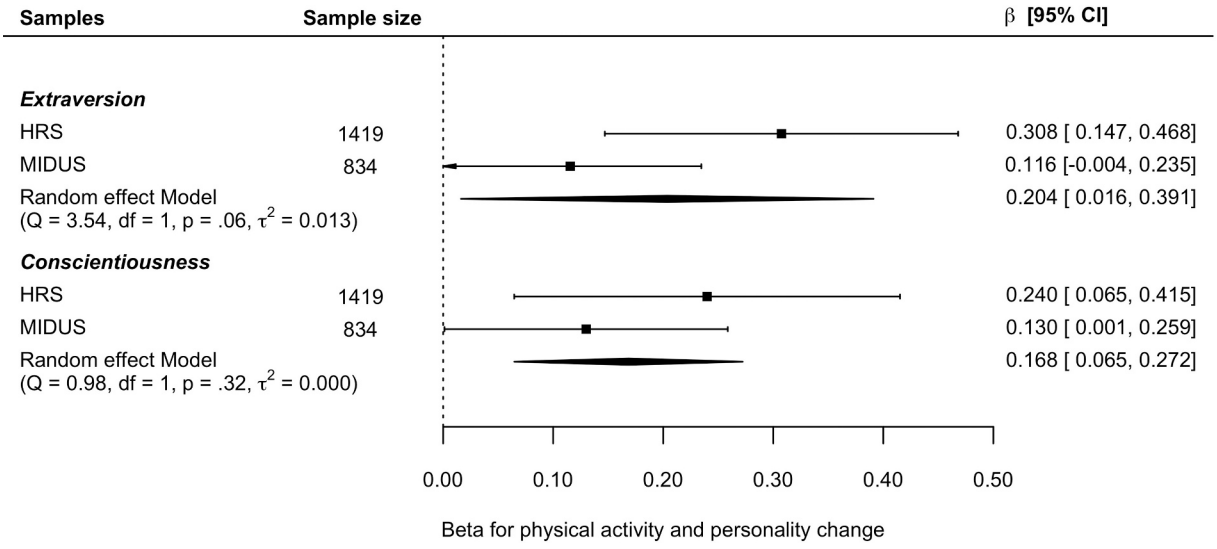

Fig. 1. Forest plots of the association between personality change and between-person physical activity.
Note. HRS: Health Retirement Study; MIDUS: Midlife in the United States; CI: confidence intervals.

et al., 2015;Allen et al., 2017 ; Stephan et al., 2014 ; Stephan et al., 2018). However, this study adds to existing knowledge by providing the first evidence of this association in people with CRD who have specific physical activity patterns.

First, these findings provide new insights into the understanding of personality change in clinical populations. Given that the onset of CRD has been associated with personality change that could negatively impact health outcomes (Jokela et al., 2014; Wright & Jackson, 2023b), our results suggest that physical activity may mitigate these trajectories and help account for within-person variability around these trajectories (Wright & Jackson, 2025). Physical activity could influence these trajectories through multiple mechanisms, such as personality states or biological mechanisms, particularly in clinical populations. For example, some studies have shown that more physically active people with CRD have lower levels of systemic inflammation compared to those with lower physical activity levels (Waschki et al., 2012). Yet, lower levels of C-reactive protein, a biomarker of inflammation, are associated with smaller decreases in extraversion and conscientiousness (Stephan et al., 2016). Furthermore, higher physical activity in COPD has been associated with a lower risk of cognitive decline (Van Beers et al., 2018), which is related to slower decreases in extraversion and conscientiousness (Stephan et al., 2021; Terracciano et al., 2023). Higher physical activity is also related to better physical fitness (Andersson et al., 2013), which may enhance the ability of people with CRD to engage in regular extraverted and conscientious behaviors. Finally, higher physical activity may provide more opportunities for social interactions in daily life

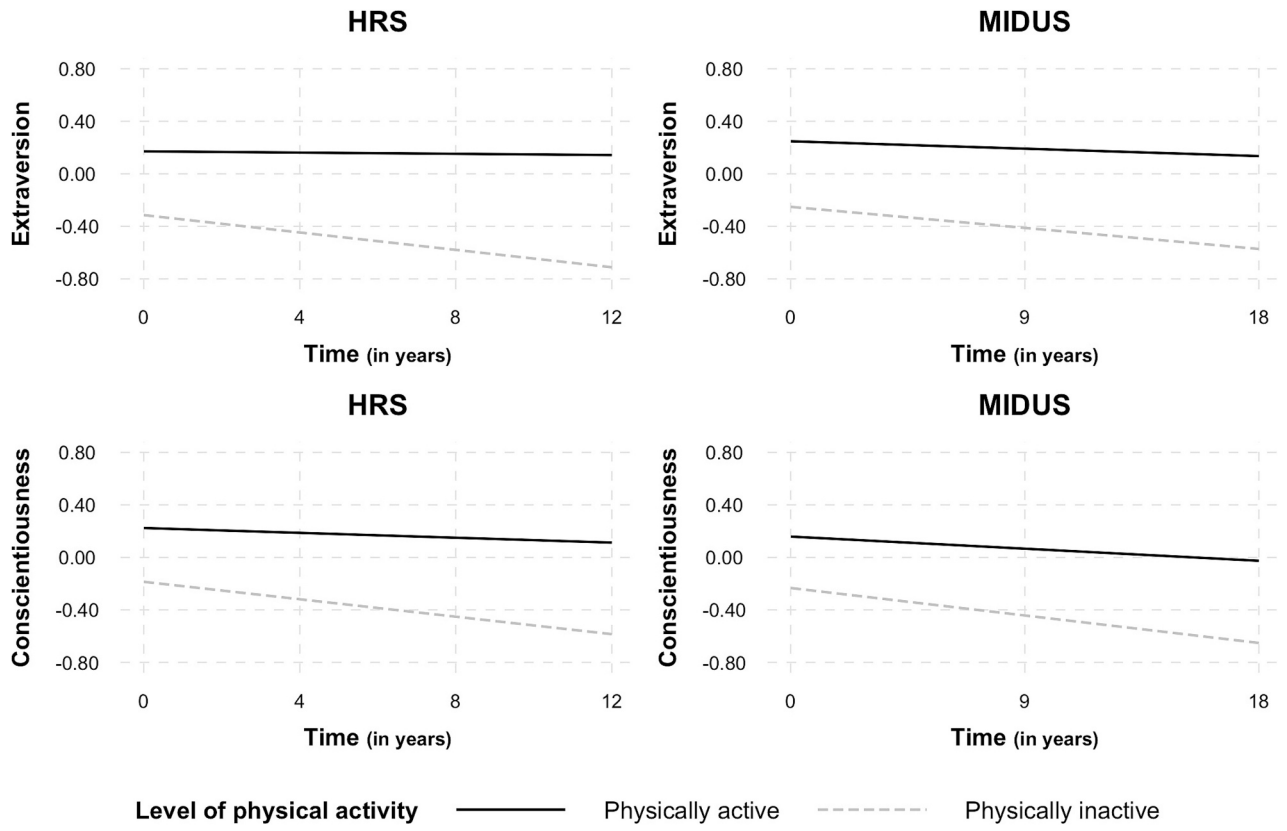

Fig. 2. Physical activity and personality change in the two samples.
Note. The black lines represent personality trajectories for an individual who remained physically active throughout the follow-up period, while the grey lines represent trajectories for an individual who remained physically inactive over the same period.

and require organizational skills, which can influence extraversion and conscientiousness states.

In line with previous research, physical activity was not related to neuroticism change (Allen et al., 2017; Stephan et al., 2014; Stephan et al., 2018). This finding is consistent with studies showing that physical activity is not associated with depressive symptoms and anxiety in individuals with CRD (Waschki et al., 2012). Additionally, the meta-analysis did not show an association between openness and agreeableness changes and physical activity in people with CRD. Despite these significant results in the meta-analysis of Stephan et al. (2018), mixed results were found across the different samples. This may reflect trait-specific differences, as openness is more stable than other traits such as agreeableness and conscientiousness (Bleidorn et al., 2022), and agreeableness shows no significant relationship with physical activity in cross-sectional studies (Wilson & Dishman, 2015). The relationship between physical activity and openness and agreeableness changes may be different in people with CRD compared with the general population. Further studies are needed to replicate this finding in other samples.

The moderating role of physical activity on personality trajectories in CRD, as illustrated by attenuated declines in extraversion and conscientiousness, has important implications for health. These changes could potentially affect health outcomes related to CRD, such as health-related quality of life or pulmonary function (Axelsson et al., 2013; Stephan et al., 2023). However, while such personality changes are related to consequences on health at the population level (Wright & Jackson, 2023b), their effects may vary at the individual level depending on personal and contextual factors (Klimstra & McLean, 2025). In addition, personality trajectories may partially explain the association between lower physical activity and deleterious outcomes in people suffering from CRD. For example, prior study found that people who experience decreases in the five traits (neuroticism reversed as emotional stability) tend to have steeper declines in cognitive function (Stieger et al., 2021). Given that lower physical activity is associated with cognitive decline in CRD patients (Van Beers et al., 2018), it is likely that decreases in extraversion and conscientiousness may partly account for this association. Further studies could examine whether trait changes mediate the cognitive and health deterioration in less physically active people with CRD.

Finally, although the analytic approach was rigorous, it could not establish a causal relationship between physical activity and personality change. Indeed, there is now increasing evidence of a bidirectional relationship between personality change and health changes (e.g., Luo et al., 2022). Specifically, it is possible that changes in personality traits, driven by CRD (Jokela et al., 2014), could be associated with changes in physical activity, which in turn lead to changes in these traits (Roberts & Wood, 2006). This hypothesis is supported by a study showing that changes in conscientiousness is related to changes in health-related behaviors (Takahashi et al., 2013). Exploring this potential bidirectional relationship represents an important avenue for future research.

The current study has several strengths, including a large sample of individuals with CRD and repeated measures of personality traits and physical activity. However, this study also has some limitations that should be considered when interpreting the findings. First, the heterogeneity of the meta-analysis is relatively high for some traits. This suggests that results should be interpreted and generalized with caution. Secondly, measures of physical activity and diagnosis of CRD were self-reported. Further research is needed to replicate our results with objective physical activity measures and CRD diagnosis obtained from medical records. In addition, some measures of personality traits (i.e., neuroticism, conscientiousness) have poor to questionable reliabilities, which may have biased the estimates for these traits. Nonetheless, previous research has shown that internal consistency does not moderate

observed mean-level changes in personality traits (Bleidorn et al., 2022). Third, the present study included participants with a variety of CRD. Future research may test to what extent the results of the present study could be replicated in patients with COPD, asthma or bronchiectasis, considered separately. Fourth, another limitation is related to the fact that health status was only controlled at baseline. It is plausible that some of the observed associations between physical activity and personality change could be confounded by processes related to disease progression. Fifth, other types of change, such as ipsative change or rank-order change, could provide valuable complementary knowledge about the association between physical activity and personality stability and change in people with CRD.

In conclusion, the current study shows that physical activity predicts individual differences in personality trait change among individuals with CRD, with higher levels of physical activity associated with smaller decreases in extraversion and conscientiousness. Physical activity is a vital issue in people with CRD, and interventions directed toward his promotion may contribute to more favorable trajectories of personality traits, which could support better health outcomes.

CRediT authorship contribution statement

Sébastien Kuss: Writing – original draft, Visualization, Methodology, Formal analysis, Conceptualization. **Nelly Heraud:** Writing – review & editing, Visualization, Methodology. **Pauline Caille:** Writing – review & editing, Visualization, Methodology. **Yannick Stephan:** Writing – review & editing, Visualization, Methodology. **Brice Canada:** Writing – review & editing, Visualization, Supervision, Methodology, Formal analysis, Conceptualization.

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None.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

The data are publicly available on the websites indicated in the manuscript.

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